Submitted via email to VW_Mitigation_Plan@state.de.us

April 27, 2018

Mr. Ali Mirzakhalili, P.E.
Delaware Department of Natural Resources and Environmental Control
Division of Air Quality
100 W. Water Street
Suite 6A
Dover, DE 19904

Attn: VW Settlement

Dear Director Mirzakhalili,

As the President of ROUSH CleanTech (ROUSH),[1] I write to thank the Delaware Department of Natural Resources and Environmental Control (DNREC) for the opportunity to comment on the Proposed Volkswagen Beneficiary Mitigation Plan (Draft Framework). Alternative fuel vehicles provide Delaware with the opportunity to dramatically decrease NOx emissions over even the cleanest diesel vehicles in addition to providing fleet organizations with lifetime economic and other indirect benefits.

Propane school buses in particular offer a cost-effective strategy to reduce NOx emissions and improve public health. ROUSH would like to commend DNREC for recognizing this as a strategy that not only reduces emission exposure for the most sensitive population, our children, but also offers many other important co-benefits.

ROUSH would like to support your efforts through the assistance of our partnership including a national network of Blue Bird, Ford, and other local dealerships. Over 12,000 propane-fueled buses in more than 800 school districts nationwide have been deployed by Blue Bird dealers, such as Delaware-based IG Burton. Collectively, ROUSH partners have helped deploy over 19,000 alternative fuel vehicles that have accumulated over 450 million miles.

Recommended Draft Framework Revisions

As one of the leading manufacturers and suppliers of alternative fuel technology, our company and partners have first-hand knowledge of the necessary demands particular fleet organizations have when implementing new technology. We are also intimately familiar with overcoming barriers and ensuring customer success through careful planning and after-market support.

We have provided some background information and data to support our recommended revisions to the draft framework. We respectfully request DNREC consider the following modifications:

[1] ROUSH CleanTech is an industry leader of alternative fuel vehicle technology focused on developing innovative and reliable propane fuel systems for fleets across North America.

(1) Ensuring contractor-operated buses are eligible since many school districts contract out pupil transportation services, and therefore do not own their own school buses.
(2) Replace #6 on page 9 of the Draft Framework with language that includes language requiring the latest model year school bus (and engine) commercially being sold is used as the replacement bus. 2019 model year engines are actually already being used in school buses ordered today.

We've provided additional information below to consider, which further supports our recommendation to DNREC to maintain a propane school bus replacement program as a cornerstone strategy of the Draft Framework.

Propane School Buses Offer the Most Cost-Effective Solution to Reduce NOx Emissions

ROUSH's model year 2017 propane school buses recently received its CARB certification at 0.05 grams NOx per brake horsepower-hour (g/bhp-hr).[2] This new propane engine is 75 percent cleaner than today's cleanest diesel engines that are compliant with the model year 2010 standard of 0.2 g/bhp-hr NOx and 99 percent cleaner than the oldest, pre-2007 model year buses still operating in many school districts today.[3] What's more, ROUSH is also actively working to obtain CARB certification at 0.02 g/bhp-hr NOx making it among the cleanest school bus available, especially when considering in-use emissions impacts as described in the next section.

These cleaner propane buses significantly reduce children's exposure to emissions that are associated with pre-2007 model year buses, including increased asthma emergencies, bronchitis, and school absenteeism, especially among asthmatic children.[4] Propane school buses also effectively eliminate diesel particulate matter emissions that are associated with cancer and thousands of premature deaths nationwide every year. These vehicles are a safe transportation solution because propane is non-toxic, non-carcinogenic and non-corrosive, and because their vehicle fuel tanks are 20 times more puncture-resistant than gasoline or diesel tanks.[5]

Further, propane school buses are a smart investment for Delaware fleets and businesses. Fuel cost reductions of 60 percent per gallon and operations and maintenance savings of $0.37 per mile, as compared to diesel, are documented.[6] Propane school buses can thus support your agency's efforts to achieve cost-effective NOx emissions reductions.

School Buses Present an Opportunity for Immediate Air Quality and Public Health Benefits

There are over 1,100 model year 2007 and older school buses in operation in Delaware that qualify for replacement under the Environmental Mitigation Trust criteria.

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[2] "Executive Order A-344-0074". California Environmental Protection Agency, Air Resources Board, May 15, 2017. https://www.arb.ca.gov/msprog/onroad/cert/mdehdehdv/2017/roush_hdoe_a3440074_6d8_0d05_lpg.pdf.
[3] For model year 1998 to 2003 diesel engines, EPA established a NOx emission standard of 4.0 g NOx / bhp-hr. Please refer to EPA's summary table of diesel engine exhaust emission standards for further detail.
[4] Adar, S. et al. "Adopting Clean Fuels and Technologies on School Buses. Pollution and Health Impacts in Children." ATS Journals, Volume 191, Issue 12. http://www.atsjournals.org/doi/abs/10.1164/rccm.201410-1924OC#.WA-HINUrJhE, June 15, 2015.
[5] "Propane Autogas – Safe and Reliable." Blue Bird. https://www.blue-bird.com/blue-bird/Propane-is-safe.aspx.
[6] "Propane Testimonials." Blue Bird. http://www.blue-bird.com/blue-bird/propane-testimonials.aspx.

The potential air quality benefits and the cost to achieve those are the most important data points to consider, in our opinion. Using lifecycle emissions data calculations from the 2017 Argonne National Laboratory's AFLEET tool with in-use adjustment shows that alternatives to diesel represent the most cost-effective way to reduce NOx emissions.

Table 1. NOx Reduction and Cost Effectiveness Results Comparing Diesel, Propane, CNG and Electric School Buses Over a 15 Year Service Life. School Bus pricing quoted below is based on national averages.

Type of School Bus Purchased	Average Cost	NOx Reduced (Lifetime Pounds)	Cost-Effectiveness (Cost per Pound)
Propane Conventional	$95,000	894	$106
CNG Conventional	$125,000	819	$153
Electric Conventional	$350,000	1,137	$308
Diesel Conventional	$90,000	68	$1,330

As shown in *Table 1*, there is minimal variance in the NOx reductions achieved between the alternative fuel options over the service life of a school bus. The diesel option, however, shows a significant decrease in emissions reduction opportunity over the life even despite their meeting current EPA standards. Propane is the lowest cost alternative and is also the most cost-effective alternative at reducing NOx in most cases and in school bus applications specifically. In fact, propane is 92% more cost effective than diesel at reducing NOx emissions in school buses as can be seen in the enclosed document.

In-Use Emissions Data Substantiates the Prioritization of Alternatives to Diesel

We applaud the state for prioritizing propane over diesel. We believe there is a growing evidence manual of data to support this decision. Several studies are highlighted below.

First, West Virginia University revealed that diesel school buses produced **26 times** the amount of NOx as propane school buses in a duty-cycle representative of most school buses. The Propane Education & Research Council (PERC) contracted the West Virginia University (WVU) Center for Alternative, Fuels, Engines, and Emissions to perform a research program testing in-use emissions and performance of propane versus diesel fueled engines in a school bus application.

A 2014 model year propane and diesel school bus were chosen for testing so that the school buses would have at least 25,000 miles logged. A total of 9 test routes were performed, including cold starts, hot starts and stop and go routes. Three stop-and-go route test results averaged 5.2 g/mile for the diesel school bus while the propane bus averaged 0.2 g.mile with minimal variability in measurement.[7] In other words, propane was 96% cleaner than diesel school buses over the test cycles. It is worth noting, the 2014 propane and diesel school buses used for testing met the

[7] Ryskamp, Ross. "In-Use Emissions and Performance Testing of Propane-Fueled Engines. PERC Docket 20893" West Virginia University Center for Alternative Fuels, Engines, and Emissions. March 29, 2018.

same 0.2 g/bhp-hr certification standard, as ROUSH had not launch the low NOx engine option yet.

Second, recent analysis by the International Council on Clean Transportation (ICCT) indicates that negative health impacts from diesel-sourced NOx emissions are increasing, despite regulatory limitations.[8] Indeed, laboratory-certified vehicles met mandatory emission limits but exceeded NOx emission limits for heavy-duty diesel vehicles, by 1.45 times on average in real world operation. These excess diesel NOx emissions contributed to an estimated 1,100 premature deaths in the United States in 2015.[9]

Finally, new test data published by the University of California at Riverside indicates that the selective catalytic reduction (SCR) systems on today's new diesel vehicles fall short of controlling NOx emissions in many duty cycles.[10]

Conclusion

As we prepare for the future of school bus and other transportation, ROUSH again commits to supplying its customers with a diverse, reliable set of alternative fuel engine technologies so that customers have a comprehensive solutions provider. We are happy to offer support to your office to ensure successful outreach, planning and ultimate deployment of propane school buses.

Thank you for considering our request. We look forward to continued dialogue with you and your team, and to a future collaboration that will help Delaware meet its air quality goals.

Sincerely,

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President
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[8] Anenberg, S. et al. "Impacts and mitigation of excess diesel NOx emissions in 11 major vehicle markets". Nature, 25 May 2017, doi:10.1038/nature22086.
[9] "New study quantifies global health, environmental impacts of excess nitrogen oxide emissions from diesel vehicles [press release]". The International Council on Clean Transportation, May 15, 2017. http://www.theicct.org/news/nature-impacts-diesel-nox-may2017.
[10] Boriboonsomsin, K. "Real-World Activty Patterns of Heavy-Duty Vehicles and Their implication on In-Use Emissions". ARB Research Seminar, May 31, 2017. https://www.arb.ca.gov/research/seminars/boriboonsomsin/boriboonsomsin.pdf.